Relationship between igneous and hydrothermal activities on and beneath the spreading axis of the southern Mariana Trough

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http://www.sci.osaka-cu.ac.jp/geos/geo1/harue/Masuda.html

Present volcanic activity on the back arc spreading axis and the associating hydrothermal activity have been known in the Mariana Trough south from 14 degree north. The most active volcanic and hydrothermal areas in this region are as follows: 1) 13 deg. 05 min. N (northern area), the only magma chamber was reported below the spreading ridge, and low temperature hydrothermal activity was found on the ridge axis. 2) 12 deg. 50-52 min. N, two black smoker type and one low temperature hydrothermal areas align on the line connecting the spreading ridge and off-axis seamount. Direction of the line is perpendicular to that of the known tensional stress. During the cruise of Yokosuka/Shinkai 6500, YK05-11 Leg 2, the above two areas were investigated to monitor the time-series variation of hydrothermal activities and characterize the geochemistry of the magma beneath the spreading ridge. In this report, the observation results of the volcanic activity and relationship to the tectonics are described.

In the northern area, the 4 km long track was traced mostly along the ridge axes, which are on the southern and northern segments of the active spreading ridge. Bowl-shaped depressions, which were a few to ten meters in diameter and up to 5 meters depth, were occasionally found on the ridge crest. Spattered lava, which comprises fragile glass, filled on the bottom surface of the depressions. Sheeted flow lava covering the slope of the ridge was observed close to the depressions. Large pillow lavas, more than one meter in diameters, were distributed apart from the depressions. The various types of lava shapes would be formed at the different stages of the same eruption or multiple eruptions of the same area. As reported by Kuno et al. (in this volume), the rocks of this area are basaltic-andetite to andesite. Such a high silica containing rocks show the low viscocity, probably due to the high volatile contents.

Only the low temperature hydrothermal activities were found in this area. Seawater is occasionally highly turbid and iron oxyhydroxide and silica precipitation were observed in this area. No high temperature hydrothermal activity must be present in this area, probably due to the rapid cooling of highly fractured oceanic crust in this region.

In the southern area, three hydrothermal areas, which were found in 2003-2005, were observed and hydrothermal fluids and sediments were collected. Temperatures and chemical composition of the hydrothermal venting fluids of those areas were almost the same as those previously measured (Ishibashi et al., this volume), indicating the stable activities of heat flux along the assumed fracture zone, which plays as the path for heat and fluids. Thus, the magmatic activity beneath the area is stable to supply the heat in the hydrothermal area during the observing periods.

Highly active heat emission in the southern area and the weak hydrothermal activity in the northern area imply the different features of the fractures in the both areas, reflecting the different tectonic fields.